

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0025

Roll No.

B.Tech.
(SEMESTER-IV) THEORY EXAMINATION, 2012-13
STRUCTURAL ANALYSIS – I

Time : 3 Hours]

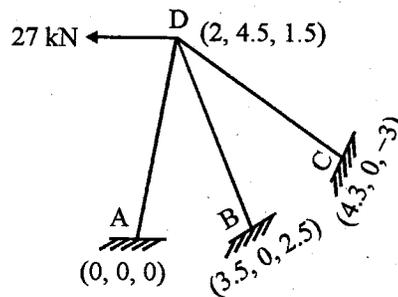
[Total Marks : 100

SECTION – A

1. Attempt **all** question parts. **10 × 2 = 20**
- (a) Define space truss with suitable sketches.
 - (b) Distinguish and differentiate between space truss and plane truss.
 - (c) What are the uses of influence lines ?
 - (d) State Muller-Breslau’s principle.
 - (e) State Eddy’s theorem. What is a linear arch ?
 - (f) What are different types of arches ?
 - (g) State and prove Betti’s theorem.
 - (h) Draw the schematic ILD for reaction SF and BM at a section when a unit load moves over a simply supported guides.
 - (i) Define shear centre.
 - (j) What do you understand about Bending of curved bars in plane of bending ?

SECTION – B

2. Attempt any **three** question parts. **3 × 10 = 30**
- (a) (i) Analyse the member forces in the three bar truss as shown in Fig. using tension coefficient method.



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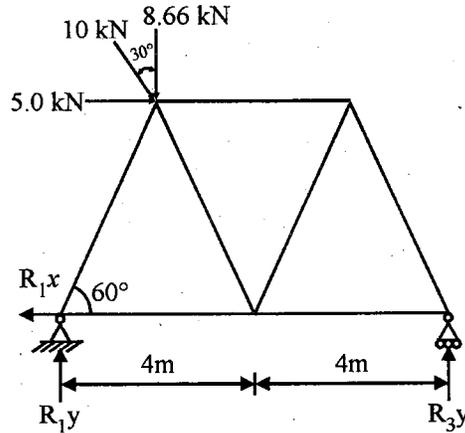


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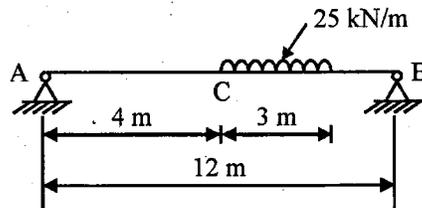
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- (ii) Analyse the truss shown in Figure for the bar forces. The 10 kN load at the joint is 30° inclined to the vertical.



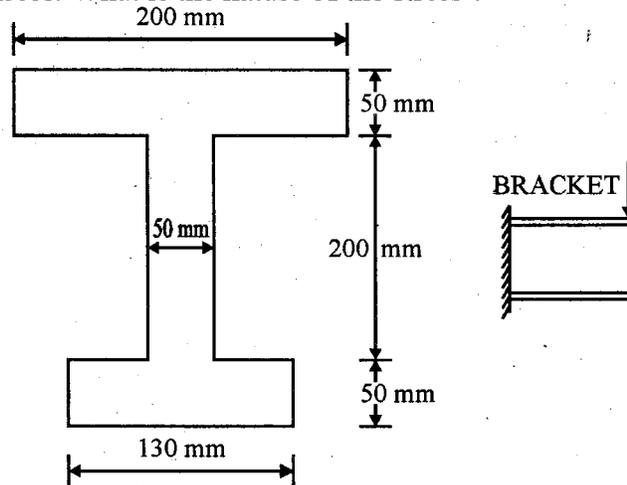
- (b) Determine the maximum shear and moment at C of beam AB shown in Fig. The intensity of a uniformly distributed load is 25 kN/m extending over a length of 3 m.



- (c) A three-hinged parabolic arch has span 16 m and central rise 4 m. It carries a concentrated load of 100 kN at 4 m from the left support. Evaluate reaction components, moment, thrust and radial shear at a section 6 m from left support. Take the equation of the arch $y = \frac{4hx}{l^2} (l-x)$ with left-hand support as origin.

Draw bending moment diagram.

- (d) State and prove the Maxwell's reciprocal theorem.
- (e) A cast iron bracket subject to bending has the cross section of I-form with unequal flanges. The dimensions of the section are shown in Fig. Find the position of the neutral axis and moment of inertia of the section about the neutral axis. If the maximum bending moment on the section is 40 MNmm, determine the maximum bending stress. What is the nature of the stress ?



SECTION – C

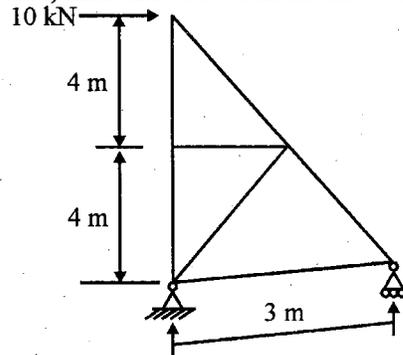
Attempt **all** questions.

5 × 10 = 50

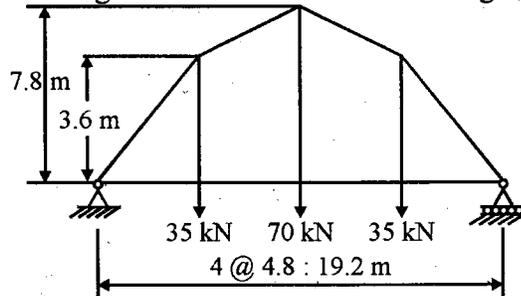
3. Attempt any **one** part.

10

(a) Using method of joints, find the forces in members of the truss shown in Fig.



(b) Analyse the stress in Fig. for the member of forces using tension coefficients method.



4. Attempt any **one** part.

10

(a) Three wheel loads 20, 80 and 80 kN, spaced 4 m apart from each other, with the 20 kN load in the lead, pass over a simply supported beam of span 20 m, determine the maximum shear and moment at a point 8 m from the left-hand support. Consider that the loading can move in either direction with the 20 kN load in the lead.

(b) Two wheel loads, 160 kN and 90 kN, spaced 4 m apart, are moving over a simply supported beam of 12 m span. Determine the maximum shear force and moment that may be developed anywhere on the beam.

5. Attempt any **one** part.

10

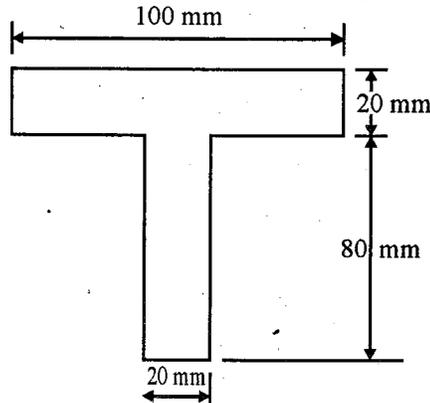
(a) The equation of the axis of a three-hinged arch is $y = x - (x^2/12)$, the origin being the left-hand support. The span and rise are 12 m and 3 m respectively. The left half of the arch is loaded with a uniformly distributed load of 30 kN/m. Evaluate :

- (i) the reaction components at the supports
- (ii) moment, radial shear and normal thrust at a section 3 m from left-hand support

(b) The equation of a three-hinged parabolic arch with its origin at its left support is $y = x - (x^2/40)$, the span of the arch is 48 m, find the normal thrust and radial shear force at a section 6 m from the left support, when the arch is carrying a uniformly distributed load of 20 kN/m over the left half of the span. Also find the section at which the maximum positive or negative bending moment will occur and the magnitude of the same anywhere on the arch.

6. Attempt any **one** part. 10
- (a) A beam AB is simply supported over a span 5 m in length. A concentrated load of 30 kN is acting at a section 1.25 m from support A. Calculate the deflection under the load point. Take $E = 200 \times 10^6 \text{ kN/m}^2$ and $I = 13.0 \times 10^{-6} \text{ m}^4$, using Maxwell's reciprocal theorem.
- (b) State and prove Castigliano's theorem.

7. Attempt any **one** part. 10
- (a) A cast iron beam is of T-section as shown in Fig. The beam is simply supported on a span of 8 m. The beam carries a uniformly distributed load of 1.5 kN/m length on the entire span. Determine the maximum tensile and maximum compressive stresses.



- (b) A simply supported beam of length 3 m carries a point load of 12 kN at a distance of 2 m from left support. The cross-section of the beam is shown in Fig. Determine the maximum tensile and compressive stress at X-X.

